Clean Technology

More Efficient Water-Splitting Cells

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method to synthesize high performance $BiVO_4$ electrodes that can be used for harnessing solar energy.

Overview

N-type bismuth vanadate ($BiVO_4$) has emerged as a promising photoanode for use in solar water-splitting cells given its favorable light absorption and conduction band characteristics. To date, however, efficiency levels hover far below what is expected because the material suffers from poor electron transport properties. Methods to address this problem by synthesizing porous $BiVO_4$ have until now yielded large particles that hinder performance.

The Invention

UW–Madison researchers have developed a method for synthesizing nanoporous $BiVO_4$ electrodes with large surface areas. The material is made up of a porous network of $BiVO_4$ particles smaller than 150 nm and coated with oxygen evolution catalyst. The small size of the particles addresses prior drawbacks by increasing a property called electron–hole separation yield. The material is made by applying a vanadium solution to a type of bismuth crystal. The mixture is heated and converted into a porous network of $BiVO_4$ particles.

Applications

- Electrodes for use in solar cells that directly utilize solar energy to drive chemical reactions such as water splitting, CO_2 reduction and biomass conversion.

Key Benefits

- Improves solar-to-chemical conversion efficiency
- Can be efficiently paired with any photocathode owing to its earlier photocurrent onset and a high fill factor
- Promising results using inexpensive materials and simple production methods
- Small particle size
- Large surface area

Stage of Development

The new electrodes have demonstrated superior electron-hole separation yields (.90 at 1.23 V versus RHE).

Additional Information

For More Information About the Inventors

- Kyoung-Shin Choi

Publications

- Kim T.W. and Choi K-S. 2014. Nanoporous $BiVO_4$ Photoanodes with Dual-Layer Oxygen Evolution Catalysts for Solar Water Splitting. Science. 343, 990-994.

Tech Fields

- Clean Technology : Biobased & renewable chemicals & fuels
- Clean Technology : Solar, wind & water technologies

For current licensing status, please contact Jennifer Gottwald at jennifer@warf.org or 608-960-9854